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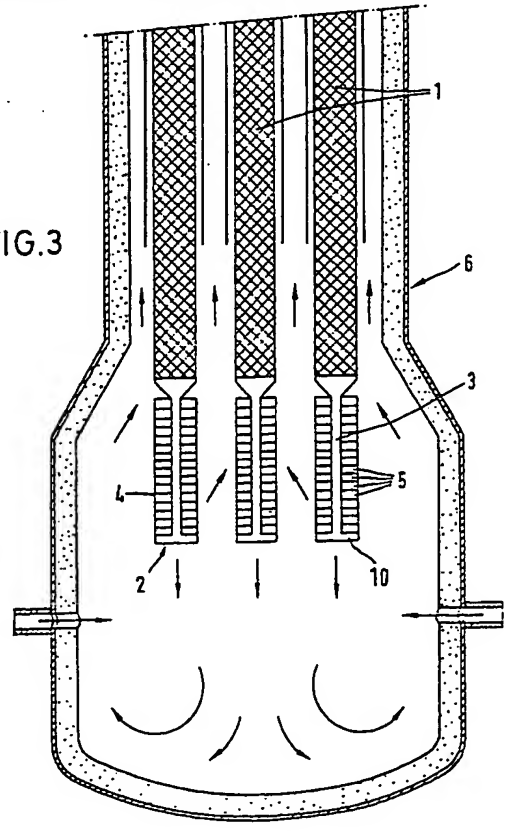
(54) Device for the production of synthesis gas

(57) A device for the production of synthesis gas in an autothermal reformer with at least one catalyst in a plurality of vertical tubes is constructed to produce an improved equilibrium adjustment and constant temperature regulation. This is achieved in that the open end (2) of each reformer tube (1) has a catalyst-free section (3) of reduced diameter surrounded by insulating material (4). The insulating material may be provided in the form of discs 5 slotting onto section 3 and interlocking. The discs may be of ceramic and have an outer catalytic layer.

FIG.3



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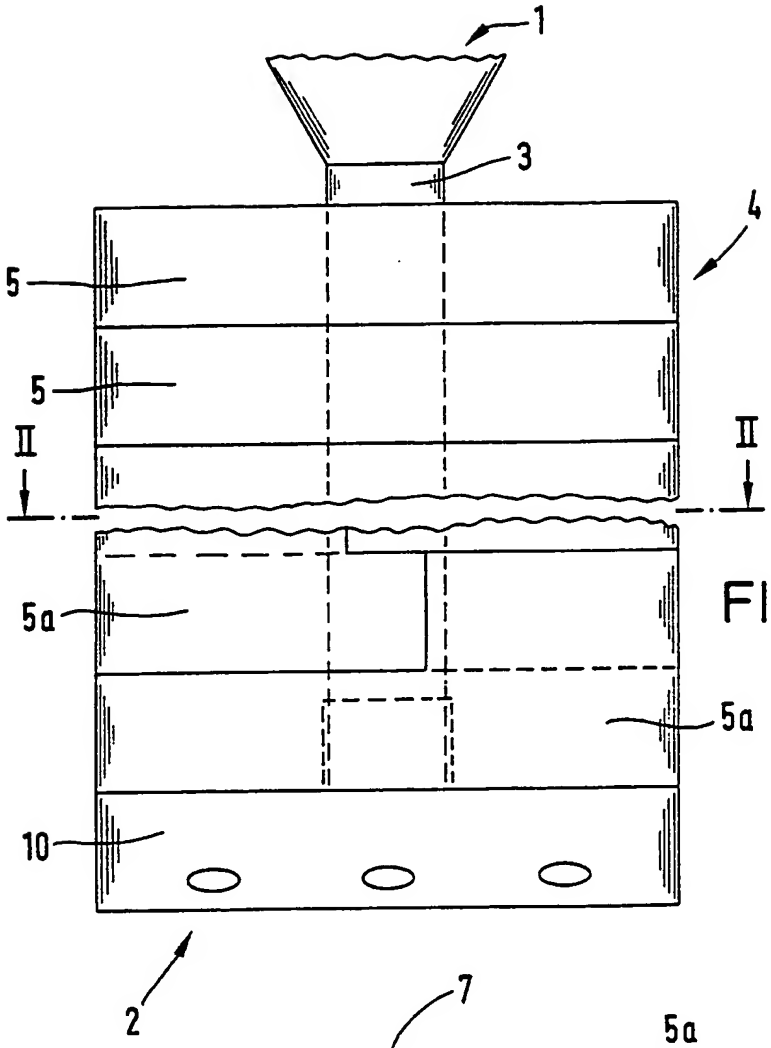


FIG.1

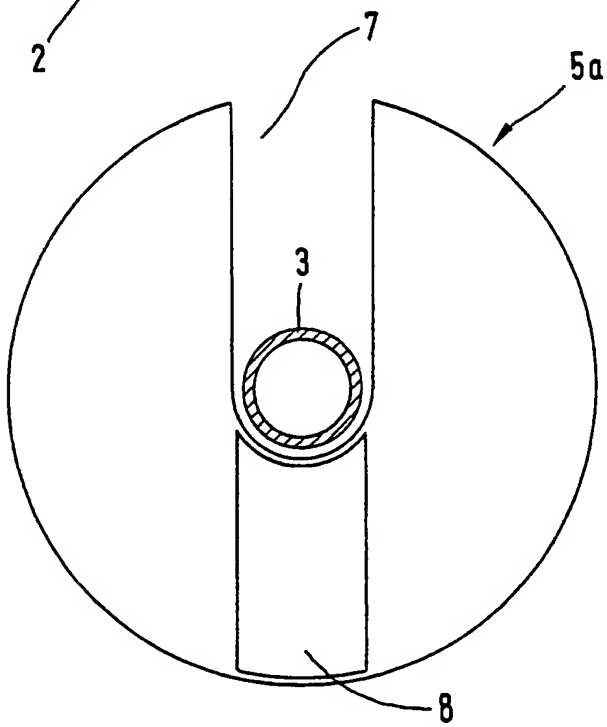
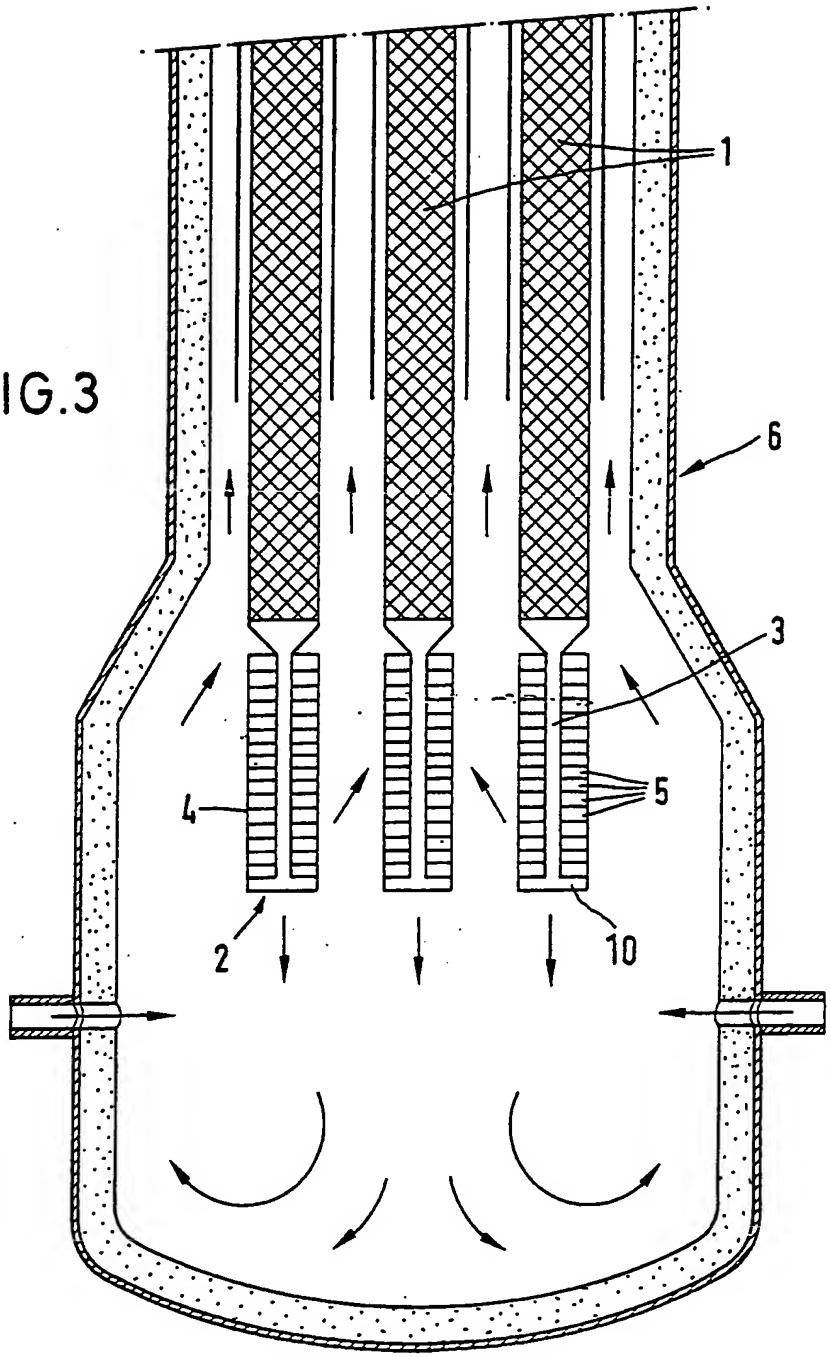


FIG.2

FIG.3



DEVICE FOR THE PRODUCTION OF SYNTHESIS GAS

The invention relates to a device for the production of synthesis gas in an autothermal reformer with at least one primary catalyst contained in a plurality of vertical tubes.

Devices of this type are already familiar in a variety of forms. The DE-OS-3244252, for example, features an upright reactor with a plurality of tubes, suspended from a tube sheet and filled with catalyst. The gas leaves the reformer tubes, passing into the inferior reaction chamber to be partially oxidised, and flows between the reformer tubes and their jackets back to the upper part of the reactor. Similar solutions are to be found in DE-OS 3532413 and DE-OS 3605811.

Depending on the configuration of the reaction chamber and the method of feeding the various gases to it, it is possible to achieve an excellent mixture of all components. Nevertheless, the equilibrium adjustment of the gas produced as well as the maintenance of constant temperature are in need of some improvement.

The purpose of the invention is thus to produce a solution with which the equilibrium adjustment and constant temperature maintenance can be improved in devices of the type in question.

This task is fulfilled in terms of the invention in that each reformer tube extends into a catalyst-free section of reduced diameter at its open end, the reduced section being surrounded by a layer of insulating material.

The invention incorporates two essential control parameters for regulating the gas equilibrium and for maintaining constant temperature: by increasing the length of the reformer tubes, it is possible to feed the gas mix further towards the center of the reformer; and the insulating in these areas ensures that the gas leaves the oxidation chamber at the optimum temperature. The insulating prevents the heat from the gas being transferred to the reformer tubes.

An embodiment of the invention provides that the insulating material should be made from an inert substance (e.g. ceramics). This has a number of advantages, that will be discussed in detail below.

The invention further provides that the insulating material is made up of discrete discs arranged vertically to form a closed cylinder, the discs being appropriately slotted to connect with the reduced diameter catalyst-free section of the reformer. The arrangement of the insulating material in the form of discs has the advantage that the length may be varied as required in accordance with the design parameters of the individual reactor. The slotted design makes it possible to replace individual discs in the event of damage without the need to remove the entire insulator.

Where the discs are slotted, at least one of them may have a portuberance that engages with the slot in an adjacent disc. A completely closed cylinder is then formed, both internally and externally.

It is advantageous for the open end of the tube segment of reduced diameter to be fitted with a gas jet member that forms a supporting element for the insulating discs. The jet members may, for example, be threaded, so that insulating discs with only central bores may also be used. These may then be arranged together on the reduced pipe section, then held in place by tightening the gas jet member beneath.

A particular advantage of the invention is that the insulating material is of an inert substance, so that at least the external surface can be catalytically coated. Thus at least the outer insulating layer may be of porous ceramic material, the catalyst being contained in the pores.

An example of the invention can be seen in the accompanying drawings, in which:

Fig. 1 shows the inferior portion of a reformer tube with two alternative types of insulating members;

Fig. 2 shows the section II-II in Fig. 1 rotated

through 90°; and

Fig. 3 shows a lower portion of a reformer pressure vessel including reformer tubes constructed according to Figs. 1 and 2.

The reformer tubes seen in the part representation of the reformer pressure vessel 6 in Fig. 3 are attached to a tube sheet (not shown). The tubes 1 are characterised by a catalyst-free section 3 of reduced diameter at their open end 2 surrounded by insulating material 4.

As shown in the upper half of Fig. 1, the insulating is composed of a series of identical discs 5 made from ceramic material able to withstand very high temperatures.

The lower part of Fig. 1 shows the configuration of the insulating discs 5a, displayed in cross-section in Fig. 2. The insulating discs 5a are characterised in that they contain a slot 7 enabling them to be placed onto the reduced section 3 of the reformer tube 1 and have a protuberance 8 located radially opposite said slot 7, which engages with the slot in the adjacent disc, thereby forming a completely closed cylinder.

The complete series of discs is supported by a jet member 10 that may, for example, be screwed onto the open end of tube 3 or secured in some other way that has no specific relationship with the invention.

Fig. 3 shows the reformer tubes 1 installed by way of example in a reformer pressure vessel 6. The direction of flow is indicated by the arrows. These serve purely as clarification and in no way constitute part of the invention. The decisive factor is the regulatory facility, as described above, by varying the length and type of the reduced diameter catalyst-free sections 3 of the reformer tubes 1.

It will be clear that the above examples can be varied in many respects without altering the essential characteristics of the invention. It is, for example, not essential for the ceramic discs 5 to be slotted.

They may equally have just a central bore, depending on the mode of attachment foreseen for the jet member.

CLAIMS:

1. Device for the production of synthesis gas in an autothermal reformer with at least one primary catalyst contained in a plurality of vertical tubes, with the open end of each reformer tube extending into a catalyst-free section of reduced diameter surrounded with insulating material.

2. Device according to Claim 1, in which the insulating material is made from inert material.

3. Device according to Claim 1 or 2, in which the insulating material is composed of discrete discs arranged vertically to form a closed cylinder, the discs being appropriately slotted where required to facilitate placing of the discs onto the section of reduced diameter of the reformer tube.

4. Device according to Claim 3, in which at least one disc has a protuberance that engages with a slot in an adjacent insulating disc.

5. Device according to Claim 3 or 4, in which the open end of the section of reduced diameter is fitted with a gas jet member that forms a supporting element for the insulating discs.

6. Device according to any one of the foregoing claims, in which the outer surface of the insulating material is catalytically active.

7. Device substantially as hereinbefore described with reference to the accompanying drawings.

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